

CLAIMS

What is claimed is:

Sub 17 1. An apparatus for augmenting near vision accommodation by

10 contraction of the ciliary muscles of the eye by reinforcement of at least one set of zonular fibers, the apparatus comprising at least one bridge affixed to the at least one set of zonular fibers.

15 2. The invention of claim 1 wherein said at least one bridge comprises a symmetric distribution of said at least one bridge.

3. The invention of claim 1 wherein said at least one bridge comprises a ring.

20 4. The invention of claim 1 wherein said at least one bridge comprises a biocompatible material.

25 5. The invention of claim 1 wherein said at least one bridge comprises a synthetic muscle .

30 6. The invention of claim 5 wherein said synthetic muscle comprises a member from the group consisting of polymer hydrogels, polymer gels, polymethylmethacrylate (PMMA), polypropylene, silicone polymers, polysilicones, light curable polymeric melts, and plastic.

7. The invention of claim 5 wherein said synthetic muscle comprises an electroactive ionic polymeric artificial muscle.

35 8. The invention of claim 7 wherein said electroactive ionic polymeric artificial muscle comprises a shape memory alloy (SMA).

5           9.     The invention of claim 7 wherein said electroactive ionic polymeric artificial muscle comprises a shape memory polymers (SMP) artificial muscle.

10           10.    The invention of claim 5 wherein said synthetic muscle comprises an active material.

10           11.    The invention of claim 10 wherein said active material comprises a member from the group consisting of inflatable mini-balloons, deployable structural mini-bridges, electromagnetically deployable solenoidal structures, piezocerams, piezopolymers, electroactive polymers, eletrostrictive polymers, 15 light curable polymers, magnetorheological materials and electrorheological materials.

20           12.    A method of correcting presbyopia and hyperopia on demand, the method comprising the steps of:

- 20                   a.     affixing at least one bridge to at least one set of zonular fibers of the eye;
- b.     transmitting a contraction force from the ciliary muscles to the at least one set of zonular fibers and the at least one bridge; and
- 25                   c.     constricting the eye lens by an augmented contraction force from the at least one set of zonular fibers and the at least one bridge.

30           13.    The method of claim 12 wherein the eye lens comprises an implanted lens.

35           14.    The method of implanting at least one bridge in an eye for augmenting near vision accommodation, the method comprising the steps of:

- 35                   a.     relaxing the ciliary muscle; and
- b.     affixing the at least one bridge to at least one set of zonular fibers.

5        15. The method of claim 14 wherein the step of affixing the at least one bridge to at least one set of zonular fibers comprises affixing the at least one bridge to the canal of Hannover.

10       16. The method of claim 14 wherein the step of affixing the at least one bridge to at least one set of zonular fibers comprises implanting the at least one bridge.

15       17. The method of claim 16 wherein the step of implanting the at least one bridge further comprises implanting the at least one bridge to span the internal surfaces of the ciliary muscle and the ciliary processes to the surface of the lens capsule.

20       18. An apparatus for augmenting near vision accommodation by contraction of the ciliary muscles of the eye by reinforcement of zonular fibers, the apparatus comprising at least three circularly distributed bridges affixed symmetrically to the zonules wherein said at least three bridges span at least a portion of the internal surfaces of the ciliary muscles and the ciliary processes to the surface of the eye lens capsule.

25       19. The invention of claim 18 wherein said at least three bridges comprise synthetic muscles.

30       20. The invention of claim 19 wherein said synthetic muscles comprise a member from the group consisting of electroactive ionic polymeric artificial muscles, light curable polymer melts and polymer gels.